

A NEW SPECIES OF THE *LITORIA BICOLOR* SPECIES GROUP FROM
SOUTHEAST QUEENSLAND, AUSTRALIA (ANURA:HYLIDAE)

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ABSTRACT

A new species of treefrog of the *Litoria bicolor* species group is described from south-east Queensland. It is distinguished from other species of that group by the male mating call, broader head and snout, presence of dark brown spots and reticulations on dorsum, and a distinct brown purplish femoral streak bordering the dorsal green colour of the thighs.

It is closely related to *Litoria glauerti* (Copland), and it occurs along coastal sandy areas.

Early in 1971 I collected a series of small green treefrogs from a Freshwater Lake, Cooloola, and these appear to be an undescribed species closely related to *Litoria glauerti*. Subsequently similar frogs were collected from Fraser Island by Rick Shine, and from Lake Coolamara in Cooloola by Peter Ogilvie. Subsequent visits to Cooloola convinced me that these frogs represented an undescribed species.

During the course of this study I have examined *Litoria bicolor* and *L. glauerti* as defined by Straughan (1969).

Most of the specimens were collected by the author and are now deposited in the Queensland Museum (QM). Techniques and abbreviations of measurements are given elsewhere (Liem and Hosmer, 1973; Liem, MS). Head length (HL) is distance from tip of snout to angle of jaws. Mouth width of tadpoles is distance between most lateral portions of labial papillar row, and body length (BL) of tadpoles is distance between tip of snout and anal opening. The following ratios were computed, TL/SV, HW/SV, HW/HL, IN/EN, and TW/ED, but only HW/HL, IN/EN ratios and SV length were useful for distinguishing the three species of this species group.

SYSTEMATICS

***Litoria cooloolensis* sp. nov.**
(Figure 1; Plate 5)

HOLOTYPE: Adult male, QM J22646 from Lake Coolamara, Cooloola, SE Queensland, collected on 27 September 1972 by David S. Liem.

PARATYPES: Eight adult males QM J22647–51 and DSL 6402, 6448, 6730, collected together with the holotype by David S. Liem.

OTHER MATERIAL: Besides the holotype and paratypes, eleven other specimens were examined: Freshwater

Lake, Cooloola (DSL 4531-39); and from Coomboo Lake, Fraser Island (DSL 5273-75). Fifteen tadpoles and eggmasses from Coolamara Lake were studied.

Fifteen individuals of *Litoria bicolor* from North Queensland were studied: Atherton Tableland, QM J12409-10; Ravenshoe, QM J10590-91; Mt. Molloy, QM J19501-02; Dimbullah, QM J16996-98, QM J17012; Yorkey Knob, QM J16992; Mareeba, QM J17016; Palm Island, QM J5306, J5309; and from Rockhampton, QM J15728.

Sixteen specimens of *Litoria glauerti* from southeast Queensland were studied: Tin Can Bay, DSL 4542, 4544, 4549; Montville near Nambour, DSL 6403-04; Samford, near Brisbane, DSL 4271, 4273, 4277, 4279, 5173, 5176, 5230, 5249, 5251; Mt. Glorious, DSL 5223-24.

DIAGNOSIS: A small sized green treefrog, less than 32 mm in SV length. It is distinguished from other Australian treefrogs by the following combination of characters: 1, small size; 2, absence of vomerine teeth; 3, dorsal background colour green with dark-brown spots and reticulations; and 4, posterior surface of thigh bright orange separated from the dorsal green colour by a distinct brown purplish femoral streak. It is distinguished from *glauerti* and *bicolor* by the longer SV length, broader head (HW/HL ratio more than 1.054), broader internarial width (IN/EN ratio more than 1.044), absence or indistinct maxillary cream streak, absence of brown loreal streak, and the peculiar diphasic male call.

DESCRIPTION OF HOLOTYPE: SV length 24.0 mm; TL 12.7 mm, 0.529 of SV length; HW 7.7 mm, 0.321 of SV length; HL 6.6 mm; HW/HL ratio 1.167; EN 2.3 mm; IN 2.4 mm; IN/EN ratio 1.044; ED 2.9 mm; TW 1.7 mm; TW/ED ratio 0.586.

Tip of snout bluntly pointed (Fig. 1A); snout slightly protruding beyond lower jaw; canthus rostralis evenly rounded; loreal region straight, slightly sloping outward; dorsal view of head bluntly pointed; tympanum more or less distinct; supratympanic fold weak or absent; tongue oval, free posteriorly; vomerine teeth absent; upper jaw toothed. Vocal sac with two slit-like openings.

Distal segment of fingers expanded into disc; disc of 3rd finger as large as tympanum; length of fingers from shortest to longest 1-2-4-3. Fingers with vestigial webbing; web between 3rd and 4th fingers reaches their 2nd subarticular tubercles. Subarticular tubercle present, one each on 1st and 2nd fingers, two on 4th finger, and three on 3rd finger. There are three oval outer metacarpal tubercles, and an elongated inner one; supernumerary tubercles present on metacarpals and on the palm (Fig. 1B).

Hindlimbs moderately long; distal segment of toes expanded into disc with ventromarginal groove; length of toes from shortest to longest 1-2-3-5-4; subarticular tubercles simple, one each on 1st and 2nd toes, two each on 3rd and 5th toes, and three on 4th toe; supernumerary tubercles on plantar region weak or indistinct. Inner metatarsal tubercle oval, outer one absent. Foot extensively webbed; it reaches base of disc of inner margin of 5th toe, and outer margin of 2nd and 3rd toes; it reaches halfway down the proximal phalanx of 1st toe, and the 3rd subarticular tubercle of the 4th toe.

Dorsal surface shagreen; abdomen and postero-ventral surfaces of thighs coarsely granular; throat lightly tubercular.

Pupil horizontal, oval. Adult males have finely spinulated nuptial pad on base of thumb.

Colour: In life, dorsal colour green with dark-brown spots and reticulations; a narrow barely visible dark-brown loreal streak runs from anterior angle of eye to nostril, just along the ventral margin of canthus rostralis; a cream maxillary streak runs from below the eye to base of forearm; dorsal green colour of femur is bordered ventrally by a brown purplish

femoral streak meeting along a sharp line; posterior surface of thigh orange, bordering the femoral brown purplish streak along a sharp line. Ventral surfaces of body and limbs cream.

In preservative the dorsal green colour change into bluish green; orange patch on posterior surface of thigh disappears and the femoral brown purplish streak is retained.

DESCRIPTION AND VARIATION: Fifteen adult males: SV length 24.68 ± 1.480 mm (range 22.9–26.1 mm); TL length 10.9–13.6 mm, 0.452–0.535 of SV length; HW 7.0–8.5

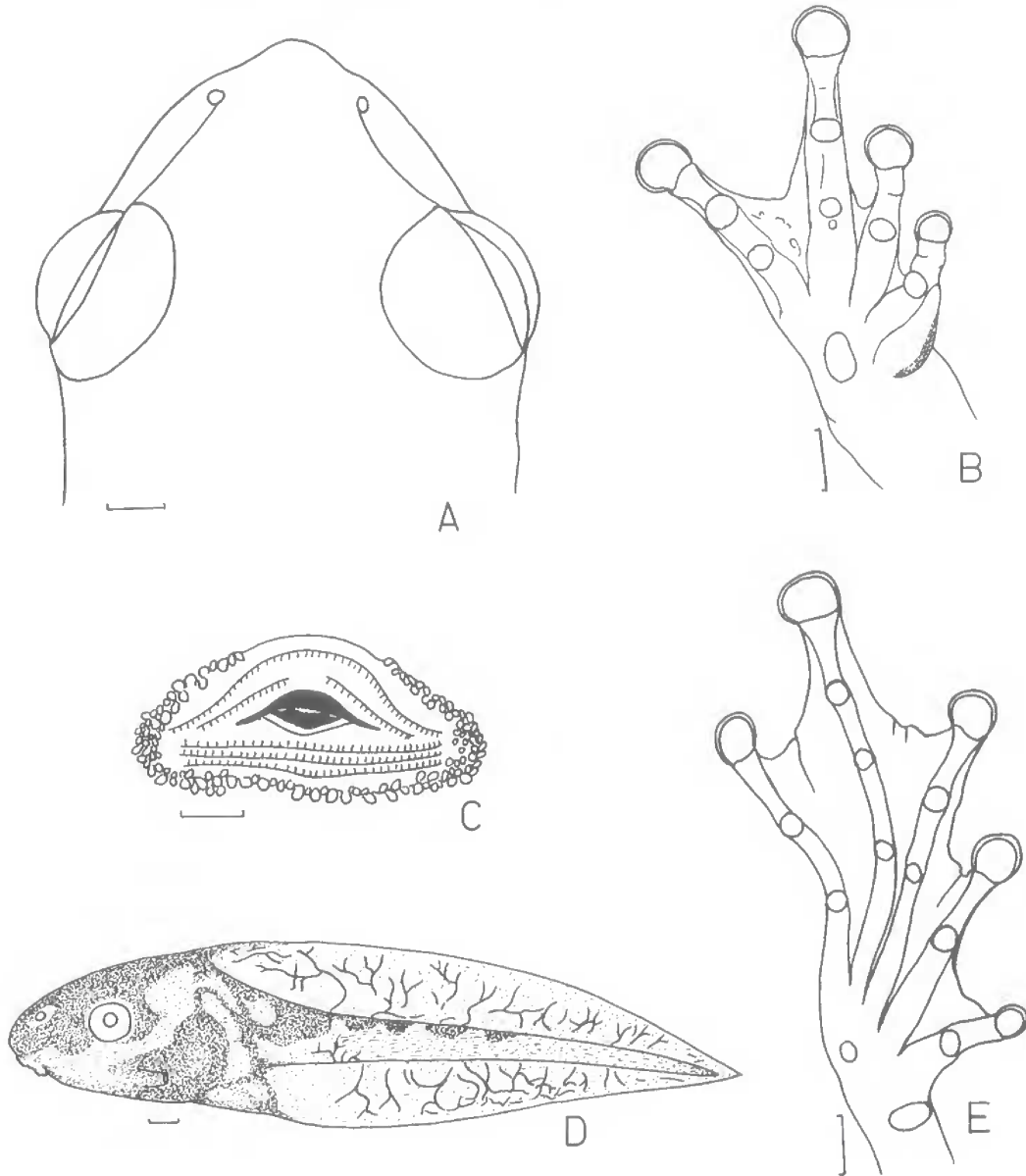


FIG. 1. *Litoria cooloolensis*. A. Dorsal aspect of head (holotype, QM J22646), B. ventral aspect of hand (QM J22651), C. mouth of a tadpole, D. lateral aspect of a tadpole at stage 25, E. ventral aspect of foot QM J22651). Line equals to 1 mm.

mm; HW/SV ratio 0.286–0.332; HL 6.6–7.8 mm; HW/HL ratio 1.039–1.167; EN 1.6–2.5 mm; IN 2.1–2.5 mm; IN/EN 1.044–1.313; ED 2.6–3.4 mm; TW 1.3–1.7 mm; TW/ED 0.457–0.586. Females are larger than males, 29.2–30.0 mm in SV length; TL 14.3–15.5 mm; TL/SV ratio 0.497–0.530; HW 9.0–9.2 mm; HW/SV ratio 0.300–0.315; HL 8.2–8.5 mm; HW/HL ratio 1.082–1.098; EN 2.5–3.0 mm; IN 2.9 mm; IN/EN 1.160–1.166; ED 3.4–3.6 mm; TW 2.0 mm; TW/ED 0.556–0.588. There are no marked differences in measurements amongst the males; females are significantly larger than males. Some individuals show less extensive foot webbing; web along outer margin barely reaching the base of disc of 2nd toe in two individuals (QM J22647, J22649); one individual (QM J22649) lacks the cream maxillary streak. Individuals from Freshwater Lake, Cooloola are darker; dark-brown spots and reticulations on dorsum and the brown loreal streak are barely visible; they also lack or with very small cream maxillary streak; foot webbing is less extensive in one individual (DSL 4534); in one individual (DSL 4538) the throat is extensively dusted with brown pigments. The brown purplish femoral streak is consistently present in all individuals studied and so is the orange patch on posterior surfaces of the thighs.

MATING CALL: A diphasic call, a short creak followed by a rattling noise at the end (call structure will be reported elsewhere). With little practice one can easily distinguish by ear, *cooloolensis* from *glauerti* and *bicolor* calls.

LIFE HISTORY: Males call from August to May, but they may also call during warm winter nights. Amplexus pairs were observed during or after rain; amplexus axillary. Small jelly encapsulated eggs are deposited on submerged vegetation; eggs with light brown animal and cream vegetal hemispheres, similar to *glauerti* and most other Australian green treefrogs.

TABLE 1

DISTRIBUTION OF CHARACTERS USEFUL FOR DISTINGUISHING SPECIES OF *Litoria bicolor* SPECIES GROUP.

Characters	<i>L. bicolor</i>	<i>L. glauerti</i>	<i>L. cooloolensis</i>
SV length (males)	22.10 ± 1.687 (N=11)	23.54 ± 1.519 (N=13)	24.68 ± 1.481 (N=15)
HW/HL ratio	0.846–0.912	0.855–0.971	1.054–1.167
IN/EN ratio	0.864–0.957	0.863–0.926	1.044–1.313
Web on 1st toe	halfway penultimate phalanx	base of disc	$\frac{1}{2}$ to $\frac{2}{3}$ penultimate phalanx
Dorsal colour	bronze and green	uniform green	green with brown spots and reticulations
Brown loreal streak	present	present	indistinct/absent
Brown head streak	present	present	absent
Maxillary cream streak	prominent	prominent	small/absent
Tympanum colour	brown	brown	green
Upperarm colour	pale yellow	pale yellow/orange	orange
Colour of posterior of thighs	pale yellow	orange	orange
Brown purplish femoral streak	absent	indistinct/absent	present

Tadpoles have a typical Australian hylid habitus, blunt snout and a pointed tail. Fifteen tadpoles at stage 25 have the following dimensions: ST length 25.0–29.0 mm, TL/ST 0.643–0.680, TH/TL ratio 0.444–0.500, MW/BL ratio 0.300–0.750. Tail is relatively high; muscular tail narrow; spiracle opens at the end of a tube on ventro-lateral left side of the body; anal opening dextral. Mouth moderately large, directed antero-ventrally; labial papillar rows consist of 1–2 layers, more at angle of jaws and is interrupted at its anterior portion (Fig. 1C). Labial tooth row formula I,1/III, similar to some populations of *glauerti* tadpoles; jaw moderate in size and serrated. Unlike the spectacular coloured *glauerti* tadpoles (will be reported elsewhere), *cooloolensis* tadpoles are dull: tail fins transparent with dark brown reticulations; head, body, and base of tail with cream (light in preservatives) and brown markings (Fig. 1D). The dull colouration of the *cooloolensis* tadpole distinguishes it from the multicoloured tadpoles of *glauerti*.

HABITAT: *Litoria cooloolensis* is restricted in sandy fresh water lakes along coastal SE. Queensland and on Fraser Island. It occurs in wallum habitats and lowland rainforest. It is synchopatric with *Litoria peroni*, *olongburensis*, *Bufo marinus*, *Crinia signifera*, *Uperoleia laevigata*, *Pseudophryne bibroni*, *Platyplectron dumerili*, and an undescribed *Litoria*.

DISTRIBUTION: At present it is known from only three localities: Freshwater Lake and Coolamera Lake in Cooloola, and in Coomboo Lake on Fraser Island, SE. Queensland.

ETYMOLOGY: The specific name refers to the locality where the holotype was collected.

STATUS AND RELATIONSHIPS

Only two species, *Litoria bicolor* (Gray) and *L. glauerti* (Copland), amongst the Australian treefrogs recognized, show any potential resemblance to the new form. Species of the *Litoria bicolor* species group are characterized by small size (less than 32 mm in SV length), dorsal green background colour, absence of vomerine teeth, vestigial finger webbing, and a characteristic diphasic mating call. The only other Australian treefrog without vomerine teeth is *Litoria microbelos* from northern Queensland; it differs from *L. bicolor* species group by its smaller size, less extensive foot webbing, and the brownish dorsal colour.

Morphologically Straughan (1969) distinguished *bicolor* from *glauerti* by its narrower head width (HW/HL ratio less than 0.92), and more or less larger tympanum (TW/ED ratio 0.667–0.750). My sample however, did not show any significant differences in both ratios: HW/HL 0.846–0.912 and TW/ED 0.507–0.592 in *bicolor* as opposed to 0.855–0.971 and 0.500–0.636 for *glauerti*. In the present study *L. glauerti* sample came from SE. Queensland whilst Straughan (1969) used North Queensland sample and probably this attributed to the difference. Because *bicolor* and *glauerti* are sympatric in North Queensland the difference between these two species in North Queensland is probably due to character displacement.

Significant characters for distinguishing *bicolor*, *glauerti* and the new form are listed on Table 1. In SV length *bicolor* is not significantly different from *glauerti* at $p < 0.05$ ($t = 2.118$, $DF = 3$), however the new form differs significantly from either *glauerti* at $p < 0.05$ ($t = 2.163$, $DF = 25$) or from *bicolor* at $p < 0.01$ ($t = 0.054$, $DF = 21$); furthermore the new form is distinguished from the two other species by a broader head (HW/HL ratio more than 1.054), and broader internarial distance (IN/EN ratio more than 1.044).

Because the new form differs from *bicolor* and *glauerti* in SV length, HW/HL ratio, and IN/EN ratio, tadpole, colouration, and the male call structure, it merits specific recognition, and I propose to name it *cooloolensis*.

Its restricted occurrence in coastal SE. Queensland and on Fraser Island, and the presence of derived characters (presence of brown spots and reticulations on dorsum and purplish brown femoral streak, absence or indistinct loreal and head streaks in *cooloolensis*), suggests that *cooloolensis* is a derived species, probably it evolved from the widely distributed and generalized *glauerti* through isolation along SE Queensland coastal pocket during the Pleistocene similar to speciation of *Crinia tinnula* (Straughan and Main, 1966).

KEY TO THE SPECIES OF THE *Litoria bicolor* SPECIES GROUP

1. IN/EN and HW/HL ratios more than 1.000; dorsal colour green with darkbrown spots and reticulations; purplish brown femoral streak bordering the dorsal green colour of the thigh *cooloolensis*
Not as above 2
2. Dorsal bicoloured, bronze and green; web on 1st toe halfway down the penultimate phalanx; posterior of thighs pale yellow *bicolor*
Dorsal colour uniformly green or brownish; web of 1st toe reaches base of disc; posterior of thighs orange *glauerti*

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PLATE 5

Litoria cooloolensis (holotype, QM J22646).

